



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/747,842

12/29/2003

Sanjeev Kaushal

CT- 002

6182

37694

7590

01/25/2006

WOOD, HERRON & EVANS, LLP (TOKYO ELECTRON)
2700 CAREW TOWER
441 VINE STREET
CINCINNATI, OH 45202

EXAMINER

MASINICK, MICHAEL D

ART UNIT

PAPER NUMBER

2125

DATE MAILED: 01/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/747,842	Applicant(s) KAUSHAL ET AL.	
	Examiner Michael D. Masinick	Art Unit 2125	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 11-14 is/are rejected.
- 7) ☐ Claim(s) 2-10 and 15-23 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 February 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4/14/04, 5/31/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claims 1-23 are pending in this application. This is the first action on the merits.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1 and 11-13 rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,127,288 to Kiyama.

3. Referring to claim 1, Kiyama shows a method of operating a thermal processing system comprising: positioning a wafer for processing by the thermal processing system on a hotplate comprising a plurality of zones (Column 4, lines 24-27); creating a dynamic thermal model of the thermal processing system (“temperature distribution of the wafer” – Column 4, line 31); establishing a plurality of intelligent setpoints using the dynamic thermal model of the thermal processing system (Column 10, lines 1-8 – This passage shows adjusting the temperatures in at least two zones based on the “thermal processing”), wherein each of the plurality of intelligent setpoints is associated with a corresponding one of the plurality of zones (Column 4, lines 24-34); and reducing critical dimension (CD) variation across the wafer, profile variation across the wafer, or uniformity variation across the wafer, or a combination of two or more thereof (See figure 11 for a determination of stress which qualifies at least as a profile variation) by

Art Unit: 2125

controlling an actual temperature of each of the plurality of zones of the hotplate using a corresponding one of the plurality of intelligent setpoints during processing (Columns 4 and 5 detail this process).

4. Referring to claim 11, Kiyama shows modeling a thermal interaction between the zones of the hotplate; and incorporating the model of the thermal interaction into the dynamic thermal model of the system (Figure 10 and explanation thereof).

5. Referring to claim 12, Kiyama shows creating a virtual sensor for estimating a temperature for the wafer; and incorporating the virtual sensor into the dynamic thermal model of the system (Column 5, lines 1-7).

6. Referring to claim 13, Kiyama shows modeling a thermal interaction between the hotplate and an ambient environment; and incorporating the model for the thermal interaction into the dynamic thermal model of the system. Examiner takes this claim to mean that the system knows how to control the heater(s) in order to deliver the correct amount of heat to the area where the wafer resides. This is shown in Kiyama in Column 9, lines 27-61.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kiyama as shown above in view of US PG PUB 2003/0173346 to Renken et al.

Art Unit: 2125

9. With reference to what has been shown above, Kiyama does not show creating a diffusion-amplification model of a resist carried by the wafer; and incorporating the diffusion-amplification model into the dynamic thermal model of the system.

10. Renken shows how diffusion-amplification of a substrate in a heating or cooling process can affect the speed at which the substrate is heated or cooled. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the information presented in Renken regarding the heating and cooling of wafers in the model of Kiyama because "Delays in reaching the bake temperature can result in substantial acid loss before deblocking can begin, contributing to the aforementioned scumming process" (Paragraph 0010 of Renken).

Allowable Subject Matter

11. Claims 2-10 and 15-23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. The following is an examiner's statement of reasons for indicating allowable subject matter:

13. Regarding claims 2-10, While Kiyama and Renken show a knowledge of the thermal qualities of the gap between the wafer and the hotplate, neither of these references taken alone or in combination with the prior art of record disclose creating a thermal model for a gap between the wafer and the hotplate, wherein a thermal response for the gap is predicted based on the estimated wafer stresses; and incorporating the thermal model for the gap into the dynamic

Art Unit: 2125

thermal model of the system. It is this thermal gap modeling and incorporation into the thermal model of the full system, in combination with the remaining elements and features of the invention, that the applicant's invention defines over the prior art of record.

14. Regarding claims 15-23, While Kiyama shows the concept of multiple zones on a hotplate with distinct control over heating areas of a wafer, neither this reference taken alone or in combination with the prior art of record disclose creating a variation vector D , wherein the variation vector comprises differences between measurement data and a desired value; parameterizing at least one nominal setpoint into a vector R comprising at least one intelligent setpoint; creating a sensitivity matrix using the dynamic thermal model; and determining the at least one intelligent setpoint by solving an optimization problem comprising $\min r$; $D - MR$; , wherein $r_{\min} < r < r_{\max}$, R is the vector comprising the at least one intelligent setpoint, M is the sensitivity matrix, α is a proportionality constant relating the measurement data to the sensitivity matrix M , and D is the variation vector. It is this vector creation and sensitivity matrix step, in combination with the remaining elements and features of the invention, that the applicant's invention defines over the prior art of record.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

16. U.S. Patent No. 6,801,295 to Inomata et al shows modification of critical dimensions of wafers in a non-uniform way using differing zones.

Art Unit: 2125

17. U.S. Patent Publication 2005/0053850 to Askerbjør shows wafer uniformity control using a baking system.

18. U.S. Patent No. 6,100,506 to Colelli et al shows a hot plate with multiple controllable heating zones controlled by a controller and temperature sensed by an infrared temperature sensor.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael D. Masinick whose telephone number is (571) 272-3746. The examiner can normally be reached on Mon-Fri, 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard can be reached on (571) 272-3749. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Michael D Masinick
Examiner
Art Unit 2125

MDM